APPENDIX 8-12

RESERVOIR CONFIGURATION TECHNICAL MEMORANDUM II

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BLACK & VEATCH

TECHNICAL MEMORANDUM

South Florida Water Management District — B&V Project 141731
EAA Reservoir A-1 — B&V File:
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Task 7.1.1.1.2 Reservoir Configuration Technical Memorandum II

To: Distribution

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1. INTRODUCTION

In October 2003, South Florida Water Management District (District) decided to pursue a "Dual Track" for the Everglades Agricultural Area (EAA) Reservoir project. While the multi-agency Project Delivery Team, lead by the Corps of Engineers, continues to develop the Project Implementation Report, the District is proceeding with the design of a reservoir (designated EAA Reservoir A-1 Project) located on land acquired through the Talisman exchange in the Everglades Agricultural Area.

The purpose of the Project as defined in the CERP is to capture EAA Basin runoff and releases from Lake Okeechobee. The facilities will be designed to improve the timing of environmental water supply deliveries to STA 3/4 (Storm Water Treatment Area 3/4) and the WCAs (Wetland Conservation Areas), reduce Lake Okeechobee regulatory releases to the estuaries, meet agricultural irrigation demands, and increase flood protection within the EAA.

This Reservoir Configuration Technical Memorandum II follows the Reservoir Configuration Technical Memorandum under Work Order 2 (WO2) which was prepared prior to this memorandum. The Reservoir Configuration Technical Memorandum under WO2 summarizes space requirements and other important issues for various embankment configurations.

2. OBJECTIVES

The objectives of this Technical Memorandum are to:

- Summarize reservoir configurations with respect to layout and reservoir volume. Specifically, the memorandum addresses the following configurations:
  - reservoir configuration within the A-1 tract
  - reservoir configuration within an area that includes the A-1 tract and up to 1/2 mile west of the western limit of the A-1 tract
  - optional depths of 12 and 15 feet
- Expand upon the configurations described in the Reservoir Configuration Technical Memorandum under WO2
- Discuss cost implications of various reservoir configurations

3. VOLUMETRIC COST BASIS

3.1 General

There are many issues and constraints regarding potential configurations for EAA Reservoir A-1. Most of these are discussed in detail in the Reservoir Configuration Technical Memorandum under WO2. This memorandum discusses and provides a basis for cost comparison among between the various configurations. Cost values given herein are comparative only and do not include all portions of construction. Additionally, no contingency or project reserve is included in the comparative costs. Further detail of what portions are and are not included can be found in Embankment Technical Memorandum II and Seepage Control Technical Memorandum II, both under Work Order 7 (WO7). This base configuration serves as a comparison for other comparative configuration costs, and a brief summary follows.

3.1.1 Location of Embankment Outer Toe

3.1.1.1. North Boundary

The north boundary was assumed to have setbacks of 150-ft from the property line, a 10-ft deep by 20-ft bottom width canal totaling 60-ft additional setback, and a 200-ft exterior bench between the exterior toe of the embankment and the seepage canal to allow space required for construction. This results in a 410-ft setback from the property line to the exterior toe of the embankment. In addition to the seepage canal, a 26-ft deep cutoff wall was included in cost derivation. The 150-ft setback is provided for access to the future reservoir A-2 site for construction equipment. Additionally, the 200-ft setback between the seepage canal and the exterior embankment toe provides some extra area for fish and wildlife usage.

3.1.1.2. East Boundary (Portion adjacent to Highway 27)

As additional setback along the highway for access to future reservoir A-2 is not needed, and no additional fish and wildlife setback was requested along this border, setbacks were reduced compared to those used along the north boundary. Therefore, a 50-ft setback from the property line, a 60-ft seepage canal, and a 150-ft exterior bench was used. This results in a 260-ft setback from the property line to the exterior toe of the embankment. The 150-ft exterior bench is required for stockpiling of material excavated from the seepage canal.

3.1.1.3 South Boundary and South Portion of the West Boundary (Portion Adjacent to the STA 3/4 Supply Canal and Along Future Reservoir A-2)

The south boundary was assumed to be constructed directly above the north levee of the existing STA 3/4 supply canal as illustrated in Figure 2. Therefore, no setback was included on these boundaries. It was assumed, however, that these two boundaries would have differing seepage control components. No seepage canal or cutoff wall was included in the south boundary, while only a 26-ft deep cutoff wall was assumed for the south portion of the west boundary.

3.1.1.4. North Portion of the West Boundary (Portion North of Future Reservoir A-2)

For the purposes of this memorandum, the northern portions of the west boundary were assumed to be identical in setback and configuration to the north boundary in order to provide access for construction equipment during construction of Phase II or Reservoir A-2.

3.2 Embankment Section

For configuration comparisons, it was assumed that an earthen embankment, as illustrated in Embankment Alternative No. 1 in the Appendix, was applicable. The height and side slopes of the reservoir were established according to Embankment Technical Memorandum II under WO7 at 27.8-ft tall and 3H:1V slopes. See Table 2 in the Embankment Technical Memorandum II under WO7 for reference.

3.3 Volumetric Cost Calculations

The location of the exterior toe of the embankment was established based on the set backs identified. Once the location and dimension of the embankment were established, a reservoir volume could be calculated. Additionally, a comparative cost for configuration could also be established according to the values given in Embankment Technical Memorandum II and Seepage Control Technical Memorandum, both under WO7. For each case, the comparative cost was divided by the calculated volume, resulting in the volumetric cost.

4. RESERVOIR ALTERNATIVES

4.1 Addition of Area A-1a

Required under Work Order 7 was a cost comparison for the inclusion of an additional 1/2-mile wide section along the Future A-2 reservoir. This area includes storage volume that would otherwise be added under Phase II. This addition of volume would add about 10,000 acre feet of storage capacity to Reservoir A-1, but has little impact on the volumetric cost. The information given in Table 3 summarizes the impact. The volumetric cost shown is based on a maximum 12' water depth. This trend established for volumetric costs would not differ significantly for other depths. Based on this evaluation, it does not appear that the addition of the 1/2 mile western tract offers any significant advantage.

4.2 Optimum Water Depth

Work Order 7 requires that reservoir alternatives for 12-ft and 15-ft water depth be analyzed and discussed with relation to comparative cost. Additional depths of 6, 10, and 18-ft were selected in order to provide a broader base of comparison. As depth increases, storage volume increases at a greater rate than costs increase due to the large footprint from EAA Reservoir A-1.

4.3 Corner Configuration

As outlined in the Reservoir Configuration Technical Memorandum under WO2, curved reservoir corners can provide many benefits. On a volumetric basis, the curved corner results in a cost/acre-foot savings. However, there is a reduction in volume. Additionally, the use of curved corners may not be practical for all corners:

- In the southwest corner the earthen embankment alignment would be consistent with the existing STA 3/4 levee alignment.

- In the southeast corner, modification of the G-370 pump station to pump directly into the reservoir would require that the reservoir embankment be adjacent to the pumping station, specifically on the discharge side of the pump station. However, some curved or angled configuration would be beneficial in this corner in order to accommodate existing helipads in the vicinity and provide for the possible addition of a control structure to release to the suction canal for G-370.
- In the northeast corner, the location of the new north east pumping station may result in an embankment alignment that assumes a more rectangular shape.

4.4 Fish and Wild Life Goals

The Reservoir Configuration Technical Memorandum under WO2, states that the Fish & Wildlife Service has requested additional setback from the property line along the northern and western boundaries in order to establish a wild life habitat buffer zone and improve ecological stability and resiliency. This additional setback would decrease the available storage at a small decrease in volumetric cost as shown in Table 4.

As an option, because the current configuration allows a 150’ setback along the east boundary for stockpiling during construction, a portion of this could be used for wet lands after construction efforts are completed. The total area provided along the north and east boundaries would then be greater than providing a 350-ft setback without the subsequent reduction in storage volume.

4.5 Embankment Setback from STA 3/4 Supply Canal

As stated in Section 3.1.1 of this memorandum, it was assumed that the southern and the southern portion of the western boundaries would be constructed above the north levee of the existing STA 3/4 supply canal. If this configuration is not selected, the embankment would need to be setback from the existing seepage canal. This additional setback would decreases volume, and result in an increase in volumetric costs. The volumetric cost increase is due largely to the negation of cost savings that constructing the embankment over the existing seepage canal accrues. A description of these costs saving is given in greater detail in the Embankment Technical Memorandum under WO7. The impacts are summarized in Table 5.

4.6 Impact of Embankment Type

Also of consideration for reservoir configuration is the selection of an embankment type. As described in greater detail in the Embankment Technical Memorandum II under WO7, a Roller Compacted Cement (RCC) embankment proposed by the Jacksonville District of the USACE is under consideration as well. If this embankment, as illustrated in Figure 1, is selected, storage volume would increase due to the narrower embankment section. However, if the RCC section is selected, it would not be possible to construct over the existing STA 3/4 levee and would be necessary to setback the embankment along that portion of the boundary. This would negate any additional storage volume and volumetric cost savings as shown in Table 6.

4.7 Conclusions

Each configuration alternative described above in Sections 4.1 through 4.6 above offer both advantages and disadvantages that should be weighed along with the recommendations set forth in technical memoranda of Work Order 2 and 7. The following conclusions can be drawn:

- The expansion of the A-1 reservoir into the 1/2 mile tract immediately west of the A-1 tract offers no substantial cost savings based on a volumetric cost analysis
- Optimum depth based on volumetric cost analysis appears to be between 21 to 24 feet. However, this size of embankment may not be feasible due to current budget constraints and the results of the water balance (volume may not be needed at the time). If there is interest in pursuing greater depth, further evaluation is warranted
- The use of curved corners, where practical, should be considered for minor cost savings
- Fish and wildlife goals could be better accommodated with no additional reservoir volume loss by using the 200 ft setback between the seepage canal and the embankment along the east and north perimeter rater than introducing additional setback along the north perimeter
- For the earthen embankment along the STA 3/4 supply canal, the optimum configuration is that identified as Alternative No. 6
- Based on a volumetric cost, the earthen embankment and the RCC embankment are comparable

5. REFERENCES

Reservoir Configuration Technical Memorandum (Work Order No. 2)

Embankment Technical Memorandum II (Work Order No. 7)

Seepage Control Technical Memorandum II (Work Order No. 7)

Planning Aid Letter, James J. Slack, Field Supervisor, South Florida Ecological Services Office, Florida, 2005

TABLES

Table 1 - Addition of 1/2-mile Western Tract		
Water Depth	Without Tract Volumetric Cost ($/acre-ft)	With Tract Volumetric Cost ($/acre-ft)
12'	$1,716	$1,705

Table 2 - Optimum Water Depth		
Water Depth	Rectangular Corners Volumetric Cost ($/acre-ft)	Rectangular Corners Storage Volume (acre-ft)
6'	$2,568	95000
10'	$1,845	160000
12'	$1,644	190000
15'	$1,315	240000
18'	$1,147	260000

Table 3 - Rectangular vs. Curved Corners		
Water Depth	Curved Corner Volumetric Cost ($/acre-ft)	Rectangular Corners Volumetric Cost ($/acre-ft)
12'	$1,611	$1,716

Table 4 - Setback for Wetlands Area		
Water Depth	350' Setback Volumetric Cost ($/acre-ft)	200' Setback Volumetric Cost ($/acre-ft)
12'	$1,735	$1,716

Table 5 - Setback from STA 3/4 Seepage Canal		
Water Depth	Embankment above Canal Volumetric Cost ($/acre-ft)	200' Setback Volumetric Cost ($/acre-ft)
12'	$1,716	$1,824

Table 6 - Embankment Type		
Water Depth	Earthen Embankment Volumetric Cost ($/acre-ft)	RCC Embankment Volumetric Cost ($/acre-ft)
12'	$1,644	$1,713

FIGURES

Figure 1 Embankment Alternative 1

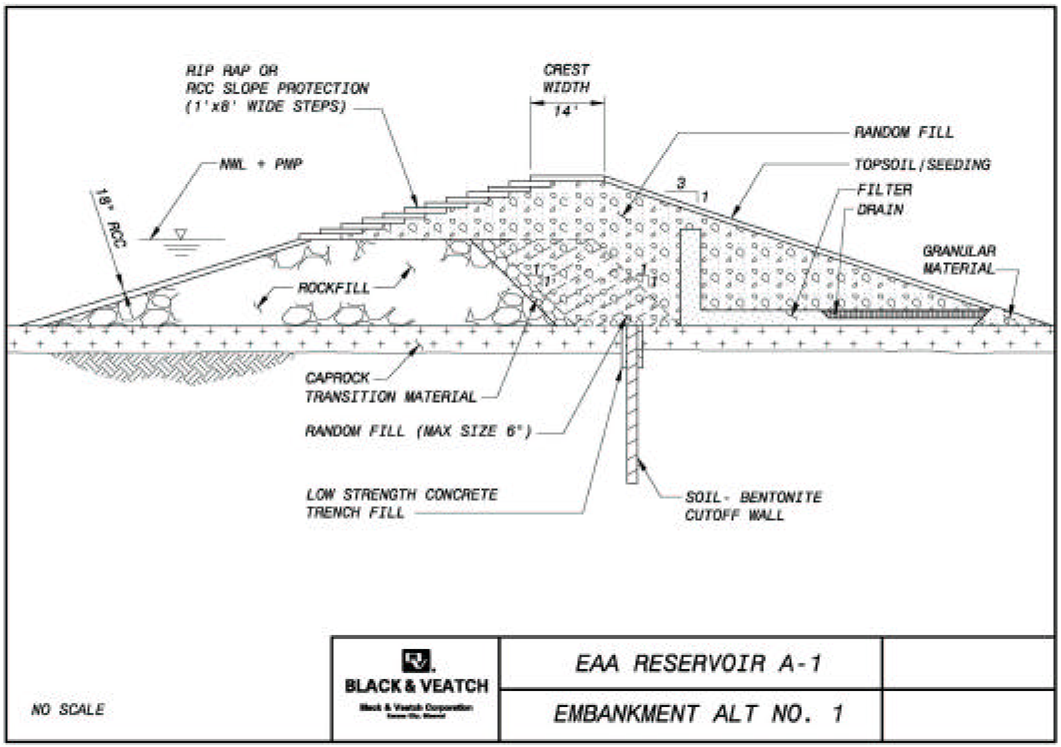

Figure 2 Embankment Alternative 4

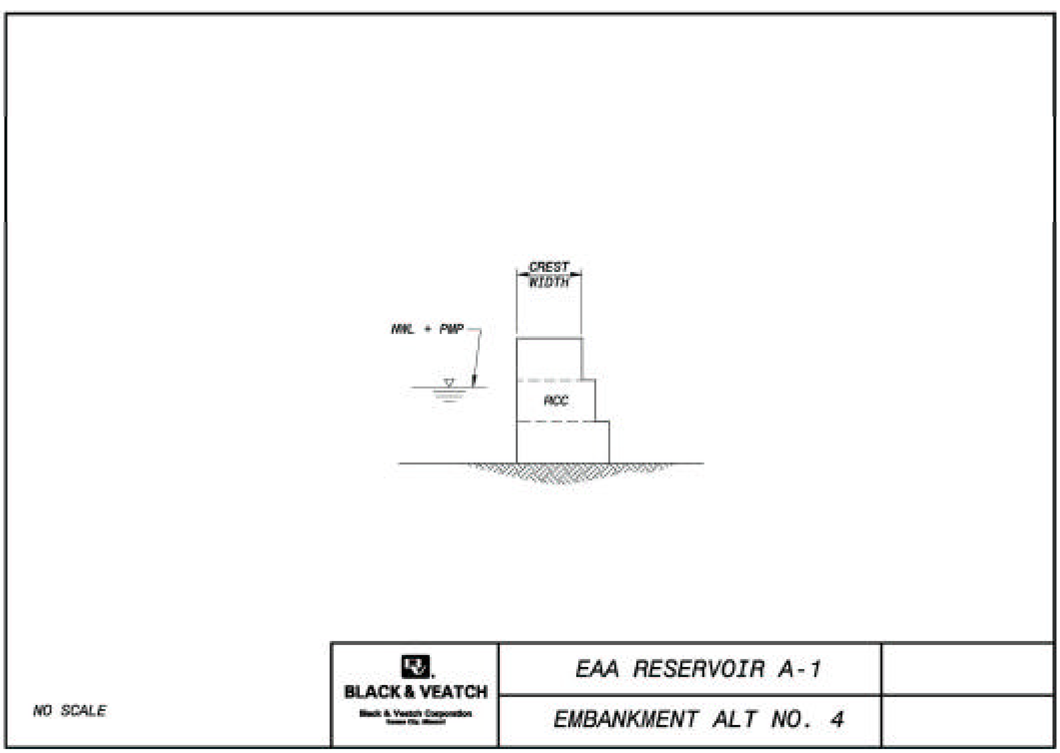

Figure 3 Embankment Alternative 6